

NJCAT TECHNOLOGY VERIFICATION

**QL-3 POWER CONTROL DEVICE
LONGLITE, LLC**

DECEMBER, 2005

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1. Introduction

1.1 New Jersey Corporation for Advanced Technology (NJCAT) Program

NJCAT is a not-for-profit corporation to promote in New Jersey the retention and growth of technology-based businesses in emerging fields such as environmental and energy technologies. NJCAT provides innovators with the regulatory, commercial, technological and financial assistance required to bring their ideas to market successfully. Specifically, NJCAT functions to:

- Advance policy strategies and regulatory mechanisms to promote technology commercialization;
- Identify, evaluate, and recommend specific technologies for which the regulatory and commercialization process should be facilitated;
- Facilitate funding and commercial relationships/alliances to bring new technologies to market and new business to the state; and
- Assist in the identification of markets and applications for commercialized technologies.

The technology verification program specifically encourages collaboration between vendors and users of technology. Through this program, teams of academic and business professionals are formed to implement a comprehensive evaluation of vendor specific performance claims. Thus, suppliers have the competitive edge of an independent third party confirmation of claims.

Pursuant to N.J.S.A. 13:1D-134 et seq. (Energy and Environmental Technology Verification Program) the New Jersey Department of Environmental Protection (NJDEP) and NJCAT have established a Performance Partnership Agreement (PPA) whereby NJCAT performs the technology verification review and NJDEP certifies the net beneficial environmental effect of the technology. In addition, NJDEP/NJCAT work in conjunction to develop expedited or more efficient timeframes for review and decision-making of permits or approvals associated with the verified/certified technology.

The PPA also requires that:

- The NJDEP shall enter into reciprocal environmental technology agreements concerning the evaluation and verification protocols with the United States Environmental Protection Agency, other local required or national environmental agencies, entities or groups in other states and New Jersey for the purpose of encouraging and permitting the reciprocal acceptance of technology data and information concerning the evaluation and verification of energy and environmental technologies; and
- The NJDEP shall work closely with the State Treasurer to include in State bid specifications, as deemed appropriate by the State Treasurer, any technology verified under the Energy and Environment Technology Verification Program.

1.2 Technology Verification Report

In June 15, 2005, Longlite LLC, with offices in Portsmouth, NH and New York City, NY, submitted a formal request for participation in the NJCAT Technology Verification Program. The technology proposed –The QL-3 Power Control Device – extends the life and reduces the energy consumption of incandescent and halogen light bulbs. The request (after pre-screening by NJCAT staff personnel in accordance with the technology assessment guidelines) was accepted into the verification program. This verification report covers the evaluation of the QL-3 based upon the performance claims of the vendor, Longlite, LLC. (Section 4).

A number of meetings, telephone discussions and email exchanges were conducted to solicit relevant materials and to refine specific claims from the vendor. This project included the evaluation of laboratory testing reports from independent testing laboratories, customers, other third parties and industry accepted relationships between voltage reduction and life extension to verify that the QL-3 meets the performance claims of Longlite, LLC.

1.3 Technology Description

1.3.1 Technology Status: general description including elements of innovation/uniqueness/ competitive advantage.

Longlite LLC's patented QL-3 technology contains a microchip that acts as a power controller to efficiently regulate voltage to a light bulb, reducing the input voltage to the light bulb by 8%. A direct relationship exists between voltage and the life of a light bulb; this relationship is known as the "Lighting Curve". According to the lighting curve, an 8% reduction in input voltage translates to a 3.13 times life extension. By achieving the voltage reduction through Longlite's patented speed switching technology the filament is not allowed to cool; consequently, visible light levels are maintained. Additionally, the voltage reduction of 8% corresponds to a wattage or energy reduction of 10%.

1.3.2 Specific Applicability

The potential market for the QL-3 is any incandescent or halogen light bulb. It can be used in all medium and candelabra based sockets for 120v or 130v bulbs up to 150 watts.

1.4 Project Description

This project included the evaluation of testing performed by nationally recognized testing laboratories, of field testing performed on-site by customers, of testing performed by third parties, and published lighting performance curves by the Illuminating Engineering Society of North America (IESNA).

1.5 Key Contacts

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2. Evaluation of the Applicant

2.1 Corporate History

Longlite, LLC “Longlite” is a pioneer in the design and manufacture of practical systems-based lighting solutions. The company’s unique product lines combine power control systems for incandescent light sources with its patented and proprietary “speed switching” microchips. The company was originally formed in 2000 under the name PowerMizer and became Longlite, LLC in 2001. Longlite is incorporated in Delaware with offices in Portsmouth, NH and New York City. The company has built a nationwide team of personnel who work with customers (commercial, industrial and government) to implement the QL-3 into their lighting program.

2.2 Organization and Management

Longlite's management team, located in the New York office, consists of Dave Callan, Chairman; Deepak Kulkarni, CEO; Jeff Drubner, President and Founder; Philip Constable, COO; and John Sweeney, EVP of Sales.

2.3 Operating Experience Relating to the Technology

Any industrial, commercial or governmental user of incandescent lighting is a potential Longlite customer. Since 2002, Longlite has implemented its Longlite QL-3 technology at companies in a variety of industries including:

- Retail
- Casinos
- Hospitality
- Restaurants
- Lighting Service
- Utilities
- Lighting Showrooms
- Furniture Showrooms
- Sign Companies

2.4 Patents

Longlite's products are protected by 2 patents, 3 patents pending and 3 patents in development, as well as by the extensive "know how" built up over the years.

2.5 Technical Resources of Staff and Capital Equipment

Research and development and day to day technical operations are overseen by Ed Rodriguez, BSEE, with over 35 years experience in the semiconductor, electronic lighting, and power module and power supply industry. The QL-3's primary component, the microchip, is manufactured in the U.S. using a proprietary process developed by Longlite.

3. Power Control Device Description

Longlite LLC's patented QL-3 technology is a power control device which extends the life and energy consumption of incandescent and halogen light bulbs. Longlite's QL-3 product is easy to use; simply peel the sticker off the QL-3 and stick it to the end of any incandescent or halogen light bulb, then screw the light bulb into the socket as normal. (See figure). The QL-3 is UL approved and works on any incandescent bulb with a standard (Edison) or candelabra base. The QL-3 can be used in all medium and candelabra based sockets for 120 volt or 130 volt bulbs up to 150 watts. The result is a light bulb that lasts longer and uses less energy.



INSTRUCTIONS FOR USE



The heart of the QL-3 technology is a proprietary “speed switching” microchip that controls and maintains light levels, while saving on energy and re-lamping costs. The QL-3 acts as a power controller to efficiently regulate voltage to the bulb; the speed switching does not allow the filament to cool. The reduction in voltage and subsequent reduction in wattage reduces energy consumption and energy costs; the lower energy flow increases the filament, and hence bulb, life. Operating incandescent and halogen lamps at a lower voltage than the lamp is designed to use, called the rated voltage, extends their life. Conversely, operating the lamp at higher than the rated voltage decreases their life. The Illuminating Engineering Society of North America (IESNA) publishes a Lighting Curve which indicates that for a 120 volt bulb an 8% drop in voltage translates into a 3.13 times life extension, while an 8% increase in voltage reduces the operating life by over 50%. This 8% voltage drop was demonstrated to NJCAT on October 26, 2005. Specifically, two Bulbrite XP MR-16 120V 50W halogen flood lamps, one with the QL-3 the other without, were tested. The voltages measured were ± 0.5 volts. The lamp without the QL-3 was measured at 120V, the one with the QL-3 at 111V, a reduction of $7.5\% \pm 0.8\%$. In addition, the wattage reduction was measured for three lamps; the average energy reduction was 11.3%.

4. Technical Performance Claims

Claim 1: For all medium and candelabra based 120 volt or 130 volt incandescent light bulbs (including halogen) up to 150 watts, the Longlite QL-3 power control device reduces the energy used by the bulb by 10 percent.

Claim 2: For all medium and candelabra based 120 volt or 130 volt incandescent light bulbs (including halogen) up to 150 watts, the Longlite QL-3 power control device extends the life of the bulb by over 313 percent.

5. Technology Performance

For Claim 1 Longlite submitted the results from a nationally recognized testing laboratory and from two customer field tests. For Claim 2 Longlite submitted the results from three (3) completed field tests performed on-site by customers and the results from one (1) on-going customer on-site test. These tests and their results were verified by contacting the responsible third party conducting the test. (Ref. 1-7)

5.1 Energy Reduction Studies

Independent Testing Laboratories, Inc. (ITL)

ITL, 3386 Longhorn Road, Boulder, CO. 80302 in December, 2004 measured the electrical characteristics of 5 bare lamp control samples for comparison to 5 samples using Longlite's QL-3 power saver device. The lamps tested were GE 120 V. 60 watt halogen 25 degree flood PAR lamps, catalog number 60PAR/H/FL25. The lamps were seasoned per IES LM-54 prior to testing. The lamps were operated at the nominal input voltage (120 V.) until stable. All testing was done with lamps in the vertical position. The input voltage, current and wattage were measured for each of the 10 lamps. This data was measured on a power analyzer with a current calibration traceable to the National Institute of Standards and Technology.

Federated/MACY's East and Energy Conservation and Supply, Inc.

On September 16, 2004 MACY's East and Energy Conservation and Supply, Inc. (Federated's energy management services company) conducted a test at Federated/MACY's East Herald Square facility in the Calvin Klein Jeans department to quantify the potential savings from the installation of the QL-3 PCD. The test was conducted by isolating a circuit with a series of PAR38 track spots. The circuit had 15 track spots. All new GE Silver Saver lamps, rated at 47 watt @ 120volt, were used in the test. The test consisted of measuring the amperage (to within 0.1 amps) in the circuit before and after the installation of the QL-3 on the 15 track spots. The voltage was assumed to remain unchanged.

Lord and Taylor

On July 23, 2004 Lord and Taylor conducted a test of the QL-3 at their store at 424 5th Avenue, NYC, NY. The test involved 61 incandescent fixtures in 8 circuits. The lamps tested were newly installed Sylvania 60PAR/Cap/Nsp. The amperage was measured on each of the 8 circuits prior to installing the QL-3 and then measured again once the QL-3 was installed. The voltage was also recorded.

5.2 Life Extension Studies

Starwood Sheraton Manhattan

Ten (10) new Phillips 65 watt 120 volt flood lights with a rated life of 1500 hours were installed in the lobby area of the Sheraton Manhattan, 790 7th Avenue at 51st Street, NY, NY 10019 on June 2, 2004. The bulbs are on 24 hours a day, 7 days a week. Five (5) of the bulbs were installed with QL-3's, five (5) bulbs without (control). The bulbs were checked on a regular basis

(21 times) until the end of the test period (January 24, 2005). The date that a bulb was observed out was recorded.

San Francisco Hilton

Seventy four (74) new Sylvania 40 watt clear 120 volt bulbs with a rated life of 1500 hours were installed in the lobby of the San Francisco Hilton, 333 O'Farrell Street, San Francisco, CA 94102 on July 20, 2004. The bulbs are on 24 hours a day, 7 days a week. Thirty seven (37) of the bulbs were installed with QL-3's. The remaining bulbs were used as a control sample. The bulbs were checked at selected intervals, approximately monthly (6 times) until the end of the test period (March 8, 2005). The date that a bulb was observed out was recorded.

Outback Steakhouse

One hundred sixteen (116) new bulbs were installed in the Outback Steakhouse, 9498 Brownsboro Road, Louisville, KY 40241 on March 8, 2004. Five (5) different bulb types were tested. QL-3's were installed on 93 bulbs and 23 bulbs were used as a control sample. The bulbs are on 15 hours a day, 7 days a week on a pre-set dimmer. The bulbs were checked at frequent intervals (24 times) until July 10, 2004 (4 months) and not again until the end of the test period (March 24, 2005). The date that a bulb was observed out was recorded.

Omni Shoreham

Sixty four (64) new bulbs were installed in the Omni Shoreham Hotel, 2500 Calvert Street, NW, Washington, DC 20008 on July 16, 2004. Two (2) bulb types are being tested: forty two (42) 25 watt candelabra 130 volt bulbs with a rated life of 2500 hours and twenty two (22) 60 watt clear 130 volt incandescent medium based with a rated life of 4000 hours. Half of each type bulb is installed with the QL-3, the other half as a control. Six (6), three (3) with a QL-3 and three (3) without, of the 42 candelabra and four (4), two (2) with and two (2) without a QL-3, out of the 22 medium based bulbs were in restaurant and on for 17 hours. The rest were in the lobby and on for 24 hours. No effort was made to differentiate whether a restaurant or a lobby bulb expired in the logbook that recorded the dates that bulbs were observed to have burned out. Since changing the hours of operation does not affect the life extension comparison as it affects both the QL-3 and control bulbs equally, and since the weighted average hours for each bulb type is essentially 23 hours, the hours of life are based on all bulbs being on 24 hours per day. The bulbs are checked at frequent intervals (15 times in 14 months). The test is still in process. The date that a bulb was observed out was recorded.

5.3 Verification Procedures

Claim 1: For all medium and candelabra based 120 volt or 130 volt incandescent light bulbs (including halogen) up to 150 watts, the Longlite QL-3 power control device reduces the energy used by the bulb by 10 percent.

The results from the three (3) energy reduction studies are shown in Table 1. The data supports verification of Claim 1.

Table 1
Energy Reduction Study Results

Test Organization	Energy Reduction Measured-%
Independent Testing Laboratories, Inc.	10.9
Federated/MACY's East and Energy Conservation and Supply, Inc.	12.0
Lord and Taylor	9.6

Claim 2: For all medium and candelabra based 120 volt or 130 volt incandescent light bulbs (including halogen) up to 150 watts, the Longlite QL-3 power control device extends the life of the bulb by over 313 percent.

The results from the four (4) life extension tests are shown in Tables 2 – 5. The exact day that a bulb burned out is not known precisely since monitoring was not conducted every day, but rather at selected intervals. Hence, for life extension calculations it was assumed that the bulb burned out at the mid-point of the monitoring period. The data in the tables show life extensions exceeding 313 percent for all the tests that are completed (326% – 738%), even though substantial numbers of the bulbs installed with QL-3's are still in service. Obviously the life extension percentage will continue to increase until all QL-3 installed bulbs burn out. In the case of the Omni Shoreham test which is still in progress, all the control bulbs have burned out, while 10 of the 21 25 watt candelabra and 8 of the 11 60 watt incandescent bulbs with the QL-3 are still operative. Hence, it is expected that when the test is completed next year the 313 percent life extension will be demonstrated at this location also.

Table 2
Starwood Sheraton Lobby Test

<u>Lamp Type Tested</u>	<u># of Control</u>	<u># with QL-3</u>	<u>Rated Life</u>	<u>% of Control Alive</u>	<u>% of QL-3 Alive</u>	<u>Control Hours of Life</u>	<u>QL-3 Hours of Life</u>	<u>Life Ext.</u>
65 Watt Flood 120 Volt	5	5	1500	0%	0%	1157	4925	426%
Operating hrs/day	24							
Start Date	6/2/2004							
Last Update	1/24/2005							

65 Watt Flood 120 Volt					Control					QL-3				
<u>Lamp #</u>	<u>Date Bulb Observed</u>	<u>Previous Check Date</u>	<u>Assumed Date of Death</u>	<u>Hours of Life</u>	<u>Lamp #</u>	<u>Date Bulb Observed</u>	<u>Previous Check Date</u>	<u>Date of Death</u>	<u>Hours of Life</u>	<u>Lamp #</u>	<u>Date Bulb Observed</u>	<u>Previous Check Date</u>	<u>Date of Death</u>	<u>Hours of Life</u>
1	8/5/2004	6/2/2004	7/4/2004	768	1	11/22/2004	11/16/2004	11/19/2004	4080	1	11/22/2004	11/16/2004	11/19/2004	4080
2	8/5/2004	6/2/2004	7/4/2004	768	2	12/22/2004	12/8/2004	12/15/2004	4704	2	12/22/2004	12/8/2004	12/15/2004	4704
3	8/5/2004	6/2/2004	7/4/2004	768	3	1/14/2005	12/22/2004	1/2/2005	5148	3	1/14/2005	12/22/2004	1/2/2005	5148
4	8/17/2004	8/10/2004	8/13/2004	1740	4	1/14/2005	12/22/2004	1/2/2005	5148	4	1/14/2005	12/22/2004	1/2/2005	5148
5	8/17/2004	8/10/2004	8/13/2004	1740	5	1/24/2005	1/14/2005	1/19/2005	5544	5	1/24/2005	1/14/2005	1/19/2005	5544
Average Hours of Life					1157					4925				

Table 3
San Francisco Hilton Test

<u>Lamp Type Tested</u>	<u># of Control</u>	<u># with QL-3</u>	<u>Rated Life</u>	<u>% of Control Alive</u>	<u>% of QL-3 Alive</u>	<u>Control Hours of Life</u>	<u>QL-3 Hours of Life</u>	<u>Life Ext.</u>
40 watt incandescent	37	37	1500	0%	68%	1548	5266	340%
Operating hrs/day 24								
Start Date 7/20/2004								
Last Update 3/8/2005								

40 watt incandescent					Control					QL-3				
<u>Lamp #</u>	<u>Date Bulb Observed</u>	<u>Previous Check Date</u>	<u>Assumed Date of Death</u>	<u>Hours of Life</u>	<u>Lamp #</u>	<u>Date Bulb Observed</u>	<u>Previous Check Date</u>	<u>Assumed Date of Death</u>	<u>Hours of Life</u>	<u>Lamp #</u>	<u>Date Bulb Observed</u>	<u>Previous Check Date</u>	<u>Assumed Date of Death</u>	<u>Hours of Life</u>
1	8/26/2004	7/20/2004	8/7/2004	444	1	1/18/2005	10/15/2004	12/1/2004	3228	1	1/18/2005	10/15/2004	12/1/2004	3228
2	8/26/2004	7/20/2004	8/7/2004	444	2	1/18/2005	10/15/2004	12/1/2004	3228	2	1/18/2005	10/15/2004	12/1/2004	3228
3	8/26/2004	7/20/2004	8/7/2004	444	3	1/18/2005	10/15/2004	12/1/2004	3228	3	1/18/2005	10/15/2004	12/1/2004	3228
4	9/14/2004	8/26/2004	9/4/2004	1116	4	2/16/2005	1/18/2005	2/1/2005	4716	4	2/16/2005	1/18/2005	2/1/2005	4716
5	9/14/2004	8/26/2004	9/4/2004	1116	5	2/16/2005	1/18/2005	2/1/2005	4716	5	2/16/2005	1/18/2005	2/1/2005	4716
6	9/14/2004	8/26/2004	9/4/2004	1116	6	3/8/2005	2/16/2005	2/26/2005	5304	6	3/8/2005	2/16/2005	2/26/2005	5304
7	9/14/2004	8/26/2004	9/4/2004	1116	7	3/8/2005	2/16/2005	2/26/2005	5304	7	3/8/2005	2/16/2005	2/26/2005	5304
8	10/15/2004	9/14/2004	9/29/2004	1716	8	3/8/2005	2/16/2005	2/26/2005	5304	8	3/8/2005	2/16/2005	2/26/2005	5304
9	10/15/2004	9/14/2004	9/29/2004	1716	9	3/8/2005	2/16/2005	2/26/2005	5304	9	3/8/2005	2/16/2005	2/26/2005	5304
10	10/15/2004	9/14/2004	9/29/2004	1716	10	3/8/2005	2/16/2005	2/26/2005	5304	10	3/8/2005	2/16/2005	2/26/2005	5304
11	10/15/2004	9/14/2004	9/29/2004	1716	11	3/8/2005	2/16/2005	2/26/2005	5304	11	3/8/2005	2/16/2005	2/26/2005	5304
12	10/15/2004	9/14/2004	9/29/2004	1716	12	3/8/2005	2/16/2005	2/26/2005	5304	12	3/8/2005	2/16/2005	2/26/2005	5304
13	10/15/2004	9/14/2004	9/29/2004	1716	13			still on	5544	13			still on	5544
14	10/15/2004	9/14/2004	9/29/2004	1716	14			still on	5544	14			still on	5544
15	10/15/2004	9/14/2004	9/29/2004	1716	15			still on	5544	15			still on	5544
16	10/15/2004	9/14/2004	9/29/2004	1716	16			still on	5544	16			still on	5544
17	10/15/2004	9/14/2004	9/29/2004	1716	17			still on	5544	17			still on	5544
18	10/15/2004	9/14/2004	9/29/2004	1716	18			still on	5544	18			still on	5544
19	10/15/2004	9/14/2004	9/29/2004	1716	19			still on	5544	19			still on	5544
20	10/15/2004	9/14/2004	9/29/2004	1716	20			still on	5544	20			still on	5544
21	10/15/2004	9/14/2004	9/29/2004	1716	21			still on	5544	21			still on	5544
22	10/15/2004	9/14/2004	9/29/2004	1716	22			still on	5544	22			still on	5544
23	10/15/2004	9/14/2004	9/29/2004	1716	23			still on	5544	23			still on	5544
24	10/15/2004	9/14/2004	9/29/2004	1716	24			still on	5544	24			still on	5544
25	10/15/2004	9/14/2004	9/29/2004	1716	25			still on	5544	25			still on	5544
26	10/15/2004	9/14/2004	9/29/2004	1716	26			still on	5544	26			still on	5544
27	10/15/2004	9/14/2004	9/29/2004	1716	27			still on	5544	27			still on	5544
28	10/15/2004	9/14/2004	9/29/2004	1716	28			still on	5544	28			still on	5544
29	10/15/2004	9/14/2004	9/29/2004	1716	29			still on	5544	29			still on	5544
30	10/15/2004	9/14/2004	9/29/2004	1716	30			still on	5544	30			still on	5544

31	10/15/2004	9/14/2004	9/29/2004	1716	31	still on	5544
32	10/15/2004	9/14/2004	9/29/2004	1716	32	still on	5544
33	10/15/2004	9/14/2004	9/29/2004	1716	33	still on	5544
34	10/15/2004	9/14/2004	9/29/2004	1716	34	still on	5544
35	10/15/2004	9/14/2004	9/29/2004	1716	35	still on	5544
36	10/15/2004	9/14/2004	9/29/2004	1716	36	still on	5544
37	10/15/2004	9/14/2004	9/29/2004	1716	37	still on	5544

Average Hours of Life

1548

5266

Table 4
Outback Steakhouse Test

<u>Lamp Type Tested</u>	<u># of</u> <u>Control</u>	<u># with</u> <u>QL-3</u>	<u>Rated</u> <u>Life</u>	<u>% of</u> <u>Control</u> <u>Alive</u>	<u>% of</u> <u>QL-3</u> <u>Alive</u>	<u>Control</u> <u>Hours of</u> <u>Life</u>	<u>QL-3</u> <u>Hours of</u> <u>Life</u>	<u>Life</u> <u>Ext.</u>
65 watt floodlight	7	14	1500	0%	71%	1418	5164	364%
50 watt small pink reflector	3	20	2000	0%	80%	1403	5199	371%
60 watt small blue	5	23	2500	0%	43%	530	3912	738%
65 watt large blue	2	7	2000	0%	100%	1751	5715	326%
40 watt incandescent	6	29	1500	0%	69%	1384	4939	357%
Operating hrs/day	15							
Start Date	3/8/2004	Note: lamps are operating on a pre-set dimmer						
Last Update	3/24/2005							

65 watt floodlight					Control					QL-3				
<u>Lamp #</u>	<u>Date Bulb</u> <u>Observed</u> <u>Out</u>	<u>Previous</u> <u>Check</u> <u>Date</u>	<u>Assumed</u> <u>Date of</u> <u>Death</u>	<u>Hours of</u> <u>Life</u>	<u>Lamp #</u>	<u>Date Bulb</u> <u>Observed</u> <u>Out</u>	<u>Previous</u> <u>Check</u> <u>Date</u>	<u>Assumed</u> <u>Date of</u> <u>Death</u>	<u>Hours of</u> <u>Life</u>	<u>Lamp #</u>	<u>Date Bulb</u> <u>Observed</u> <u>Out</u>	<u>Previous</u> <u>Check</u> <u>Date</u>	<u>Assumed</u> <u>Date of</u> <u>Death</u>	<u>Hours of</u> <u>Life</u>
1	5/25/2004	5/21/2004	5/23/2004	1140	1	3/24/2005	7/10/2004	11/15/2004	3788	1	3/24/2005	7/10/2004	11/15/2004	3788
2	5/28/2004	5/25/2004	5/26/2004	1193	2	3/24/2005	7/10/2004	11/15/2004	3788	2	3/24/2005	7/10/2004	11/15/2004	3788
3	6/2/2004	6/1/2004	6/1/2004	1283	3	3/24/2005	7/10/2004	11/15/2004	3788	3	3/24/2005	7/10/2004	11/15/2004	3788
4	6/11/2004	6/9/2004	6/10/2004	1410	4	3/24/2005	7/10/2004	11/15/2004	3788	4	3/24/2005	7/10/2004	11/15/2004	3788
5	6/22/2004	6/20/2004	6/21/2004	1575	5			still on	5715	5			still on	5715
6	6/28/2004	6/22/2004	6/25/2004	1635	6			still on	5715	6			still on	5715
7	6/29/2004	6/28/2004	6/28/2004	1688	7			still on	5715	7			still on	5715
					8			still on	5715	8			still on	5715
					9			still on	5715	9			still on	5715
					10			still on	5715	10			still on	5715
					11			still on	5715	11			still on	5715
					12			still on	5715	12			still on	5715
					13			still on	5715	13			still on	5715
					14			still on	5715	14			still on	5715
Average Hours of Life				1418					5164					

50 watt small pink reflector

Control

QL-3

<u>Lamp #</u>	<u>Date Bulb Observed</u>	<u>Previous Check Date</u>	<u>Assumed Date of Death</u>	<u>Hours of Life</u>	<u>Lamp #</u>	<u>Date Bulb Observed</u>	<u>Previous Check Date</u>	<u>Assumed Date of Death</u>	<u>Hours of Life</u>
1	6/1/2004	5/28/2004	5/30/2004	1245	1	5/27/2004	5/25/2004	5/26/2004	1185
2	6/13/2004	6/11/2004	6/12/2004	1440	2	3/24/2005	7/10/2004	11/15/2004	3788
3	6/20/2004	6/15/2004	6/17/2004	1523	3	3/24/2005	7/10/2004	11/15/2004	3788
					4	3/24/2005	7/10/2004	11/15/2004	3788
					5			still on	5715
					6			still on	5715
					7			still on	5715
					8			still on	5715
					9			still on	5715
					10			still on	5715
					11			still on	5715
					12			still on	5715
					13			still on	5715
					14			still on	5715
					15			still on	5715
					16			still on	5715
					17			still on	5715
					18			still on	5715
					19			still on	5715
					20			still on	5715
Average Hours of Life				1403					5199

65 watt large blue

Control

QL-3

<u>Lamp #</u>	<u>Date Bulb Observed</u>	<u>Previous Check Date</u>	<u>Assumed Date of Death</u>	<u>Hours of Life</u>	<u>Lamp #</u>	<u>Date Bulb Observed</u>	<u>Previous Check Date</u>	<u>Assumed Date of Death</u>	<u>Hours of Life</u>
1	7/1/2004	6/29/2004	6/30/2004	1710	1			still on	5715
2	7/10/2004	7/1/2004	7/5/2004	1793	2			still on	5715
					3			still on	5715
					4			still on	5715
					5			still on	5715
					6			still on	5715
					7			still on	5715
Average Hours of Life				1751					5715

60 watt small blue

Control

QL-3

<u>Lamp #</u>	<u>Date Bulb Observed Out</u>	<u>Previous Check Date</u>	<u>Assumed Date of Death</u>	<u>Hours of Life</u>	<u>Lamp #</u>	<u>Date Bulb Observed Out</u>	<u>Previous Check Date</u>	<u>Assumed Date of Death</u>	<u>Hours of Life</u>
1	3/24/2004	3/8/2004	3/16/2004	120	1	4/10/2004	3/28/2004	4/3/2004	398
2	3/28/2004	3/24/2004	3/26/2004	270	2	4/10/2004	3/28/2004	4/3/2004	398
3	3/28/2004	3/24/2004	3/26/2004	270	3	5/13/2004	5/6/2004	5/9/2004	938
4	5/6/2004	4/10/2004	4/23/2004	690	4	6/5/2004	6/3/2004	6/4/2004	1320
5	6/3/2004	6/2/2004	6/2/2004	1298	5	6/15/2004	6/13/2004	6/14/2004	1470
					6	7/10/2004	7/1/2004	7/5/2004	1793
					7	3/24/2005	7/10/2004	11/15/2004	3788
					8	3/24/2005	7/10/2004	11/15/2004	3788
					9	3/24/2005	7/10/2004	11/15/2004	3788
					10	3/24/2005	7/10/2004	11/15/2004	3788
					11	3/24/2005	7/10/2004	11/15/2004	3788
					12	3/24/2005	7/10/2004	11/15/2004	3788
					13	3/24/2005	7/10/2004	11/15/2004	3788
					14			still on	5715
					15			still on	5715
					16			still on	5715
					17			still on	5715
					18			still on	5715
					19			still on	5715
					20			still on	5715
					21			still on	5715
					22			still on	5715
					23			still on	5715
Average Hours of Life				530					3912

40 watt incandescent

Control

QL-3

		Date Bulb	Previous	Assumed	
		Observed	Check	Date of	Hours of
<u>Lamp #</u>		<u>Out</u>	<u>Date</u>	<u>Death</u>	<u>Life</u>
1		5/21/2004	5/13/2004	5/17/2004	1050
2		6/1/2004	5/28/2004	5/30/2004	1245
3		6/3/2004	6/2/2004	6/2/2004	1298
4		6/9/2004	6/5/2004	6/7/2004	1365
5		6/28/2004	6/22/2004	6/25/2004	1635
6		7/1/2004	6/29/2004	6/30/2004	1710

		Date Bulb	Previous	Assumed	
		Observed	Check	Date of	Hours of
<u>Lamp #</u>		<u>Out</u>	<u>Date</u>	<u>Death</u>	<u>Life</u>
1		5/26/2004	5/25/2004	5/25/2004	1178
2		6/1/2004	5/28/2004	5/30/2004	1245
3		3/24/2005	7/10/2004	11/15/2004	3788
4		3/24/2005	7/10/2004	11/15/2004	3788
5		3/24/2005	7/10/2004	11/15/2004	3788
6		3/24/2005	7/10/2004	11/15/2004	3788
7		3/24/2005	7/10/2004	11/15/2004	3788
8		3/24/2005	7/10/2004	11/15/2004	3788
9		3/24/2005	7/10/2004	11/15/2004	3788
10				still on	5715
11				still on	5715
12				still on	5715
13				still on	5715
14				still on	5715
15				still on	5715
16				still on	5715
17				still on	5715
18				still on	5715
19				still on	5715
20				still on	5715
21				still on	5715
22				still on	5715
23				still on	5715
24				still on	5715
25				still on	5715
26				still on	5715
27				still on	5715
28				still on	5715
29				still on	5715

Average Hours of Life

1384

4939

Table 5
Omni Shoreham Hotel Test

<u>Lamp Type Tested</u>	<u># of Control</u>	<u># with QL-3</u>	<u>Rated Life</u>	<u>% of Control Alive</u>	<u>% of QL-3 Alive</u>	<u>Control Hours of Life</u>	<u>QL-3 Hours of Life</u>	<u>Life Ext.</u>
25 Watt Candelabra	21	21	2500	0%	48%	3691	9230	250%
60 Watt Clear	11	11	4000	0%	73%	4432	9517	215%
Operating hrs/day	24							
Start Date	7/16/2004							
Last Update	9/29/2005							

Control					QL-3				
<u>Lamp #</u>	<u>Date Bulb Observed Out</u>	<u>Previous Check Date</u>	<u>Assumed Date of Death</u>	<u>Hours of Life</u>	<u>Lamp #</u>	<u>Date Bulb Observed Out</u>	<u>Previous Check Date</u>	<u>Assumed Date of Death</u>	<u>Hours of Life</u>
1	9/6/2004	7/16/2004	8/11/2004	624	1	1/24/2005	12/6/2004	12/30/2004	4020
2	9/6/2004	7/16/2004	8/11/2004	624	2	3/21/2005	2/14/2005	3/3/2005	5532
3	9/6/2004	7/16/2004	8/11/2004	624	3	6/6/2005	4/4/2005	5/5/2005	7044
4	9/27/2004	9/6/2004	9/16/2004	1500	4	6/6/2005	4/4/2005	5/5/2005	7044
5	11/1/2004	9/27/2004	10/14/2004	2172	5	7/11/2005	7/2/2005	7/6/2005	8532
6	11/1/2004	9/27/2004	10/14/2004	2172	6	7/11/2005	7/2/2005	7/6/2005	8532
7	11/15/2004	11/1/2004	11/8/2004	2760	7	8/20/2005	7/11/2005	7/31/2005	9120
8	11/15/2004	11/1/2004	11/8/2004	2760	8	8/20/2005	7/11/2005	7/31/2005	9120
9	11/15/2004	11/1/2004	11/8/2004	2760	9	8/20/2005	7/11/2005	7/31/2005	9120
10	12/6/2004	11/15/2004	11/25/2004	3180	10	9/29/2005	8/20/2005	9/9/2005	10080
11	12/6/2004	11/15/2004	11/25/2004	3180	11	9/29/2005	8/20/2005	9/9/2005	10080
12	12/6/2004	11/15/2004	11/25/2004	3180	12			still on	10560
13	1/24/2005	12/6/2004	12/30/2004	4020	13			still on	10560
14	1/24/2005	12/6/2004	12/30/2004	4020	14			still on	10560
15	1/31/2005	1/24/2005	1/27/2005	4692	15			still on	10560
16	2/14/2005	1/31/2005	2/7/2005	4944	16			still on	10560
17	3/21/2005	2/14/2005	3/3/2005	5532	17			still on	10560
18	3/21/2005	2/14/2005	3/3/2005	5532	18			still on	10560
19	4/4/2005	3/21/2005	3/28/2005	6120	19			still on	10560
20	6/6/2005	4/4/2005	5/5/2005	7044	20			still on	10560
21	9/29/2005	8/20/2005	9/9/2005	10080	21			still on	10560
Average Hours of Life				3691					9230

60 Watt Clear**Control****QL-3**

	Date Bulb	Previous	Assumed			Date Bulb	Previous	Assumed	
	Observed	Check	Date of	Hours of		Observed	Check	Date of	Hours of
<u>Lamp #</u>	<u>Out</u>	<u>Date</u>	<u>Death</u>	<u>Life</u>	<u>Lamp #</u>	<u>Out</u>	<u>Date</u>	<u>Death</u>	<u>Life</u>
1	9/6/2004	7/16/2004	8/11/2004	624	1	4/4/2005	3/21/2005	3/28/2005	6120
2	9/6/2004	7/16/2004	8/11/2004	624	2	6/6/2005	4/4/2005	5/5/2005	7044
3	9/27/2004	9/6/2004	9/16/2004	1500	3	6/6/2005	4/4/2005	5/5/2005	7044
4	12/6/2004	11/15/2004	11/25/2004	3180	4			still on	10560
5	1/24/2005	12/6/2004	12/30/2004	4020	5			still on	10560
6	1/24/2005	12/6/2004	12/30/2004	4020	6			still on	10560
7	2/14/2005	1/31/2005	2/7/2005	4944	7			still on	10560
8	3/21/2005	2/14/2005	3/3/2005	5532	8			still on	10560
9	4/4/2005	3/21/2005	3/28/2005	6120	9			still on	10560
10	7/2/2005	6/6/2005	6/19/2005	8112	10			still on	10560
11	9/29/2005	8/20/2005	9/9/2005	10080	11			still on	10560
Average Hours of Life				4432					9517

The data from the three (3) completed life extension tests (Starwood Sheraton Manhattan, San Francisco Hilton, and Outback Steakhouse) supports Claim 2. It is expected, based on the high percentage of QL-3 bulbs still in service, that the Omni Shoreham Hotel test, when completed, will also support this claim.

6. Technical Evaluation Analysis

6.1 Verification of Performance Claims

An evaluation of the testing performed by a nationally recognized testing laboratory and by customers on-site, indicates that the QL-3 power control device decreases energy usage by over 10%, thus verifying Claim 1. Life extension testing on-site by three (3) customers clearly demonstrates that the QL-3 power control device extends bulb life by over 313%, verifying Claim 2.

7. Net Environmental Benefit

The NJDEP encourages the development of innovative environmental technologies (IET) and has established a performance partnership between their verification/certification process and NJCAT's third party independent technology verification program. NJDEP, in the IET data and technology verification/certification process, will work with any company that can demonstrate a net beneficial effect (NBE) irrespective of the operational status, class or stage of an IET. The NBE is calculated as a mass balance of the IET in terms of its inputs of raw materials, water and energy use and its outputs of air emissions, wastewater discharges, and solid waste residues. Overall the IET should demonstrate a significant reduction of the impacts to the environment when compared to baseline conditions for the same or equivalent inputs and outputs.

There are several environmental benefits directly attributable to the Longlite QL-3 Power Controller. These benefits can be grouped in two primary categories: 1) reduced emissions resulting from the QL-3 energy savings and 2) reduced landfill volume and associated toxins.

The QL-3 reduces the energy consumption (watts) of any incandescent or halogen bulb by 10%. This energy savings directly reduces the amount of emissions that are a by-product of the production of electricity. Electricity can be generated by many methods (coal, oil, nuclear, wind, solar, hydro) and each method has an average rate of emissions. NJDEP and the NJBPU use the average emissions from the Pennsylvania-New Jersey-Maryland (PJM) grid when calculating emission savings. The latest emission numbers for PJM (2004) are:

- Carbon Dioxide = 1194.4666 lbs per MWh
- Sulfur Dioxide = 8.5055 lbs per MWh
- Nitrous Oxides = 2.8576 lbs per MWh

By way of an example, using these PJM average emission rates, for every 1,000 90 watt Halogen lamps (with a 3,000 hour average life), the use of Longlites' QL-3 will reduce emissions by:

- 101,000 lbs. of CO₂
- 720 lbs. of SO₂
- 240 lbs. of NO_x

In addition to saving 10% energy, the QL-3 also extends the bulbs life by over 313%. Accordingly, people who use the QL-3 will discard 213% less bulbs per year into landfills. The potential for reducing landfill volume through incandescent lamps may seem trivial at first glance. However, when one considers that there are approximately 5 billion of these lamps sold in the U.S. each year, the reduced volume is significant. In addition, each bulb contains lead in the glass and in the solder; reducing bulb discards to our landfills results in a reduction of lead introduced into the environment.

8. References

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